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ABSTRACT

A study was conducted to ascertain which characteristics of instructional films affect learning. Fourteen versions of a film designed to teach the assembly of part of an anti-aircraft gun were prepared and shown to different groups of trainees. The study examined the following factors: 1) number of words of narration used to describe the action, 2) inclusion of a sequence explaining how the gun worked, 3) audience participation, in which trainees tried to assemble the gun at the same time the procedure was shown on screen, and 4) succinct treatment (the use of a concise but complete film presentation taken from an existing training film). The results showed that about 100 words per minute of film produced the most effective learning. Too few or too many words impeded instruction. The sequence explaining how the gun worked did not improve performance in assembling it. Audience participation worked if the film went slowly enough to allow trainees to watch it and do the task too. Succinct treatment was ineffective. Simply using the technical names of parts in the film did not teach those names to the trainees. (Author/JK)

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TECHNICAL REPORT - SDC 269-7-11

EFFECTS ON TRAINING OF EXPERIMENTAL FILM VARIABLES STUDY II: VERBALIZATION, "HOW-IT-WORKS", NOMENCLATURE, AUDIENCE PARTICIPATION, AND SUCCINCT TREATMENT

(Rapid Mass Learning)

The Pennsylvania State College
Instructional Film Research Program
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SUMMARY

Introduction

The purpose of this study was to evaluate the effects on learning of certain characteristics of instructional films designed to teach an assembly task, and audience participation as a film utilization technique. The following characteristics were studied:

1. Level of Verbalization, or the number of words used in the narration to describe the action on the screen (expressed in average number of words per minute of film).

2. The inclusion of a sequence explaining "how-it-works", or the principles of operation of the mechanism to be assembled.

3. Audience participation, in which trainees actually attempted to assemble the mechanism at the same time as the assembly procedure was being shown on the screen.

4. Succinct treatment, or the use of a concise but complete film presentation taken from an existing training film.

In addition, the effectiveness of two of the film versions for teaching technical nomenclature was studied.

The task to be learned was the assembling of the breech block of the 40mm antiaircraft gun. Speed in correctly assembling the breech block was used to measure the effectiveness of the various film characteristics.

Procedure

Fourteen different versions of a film on the assembly of the breech block were used to investigate the effects of the above mentioned film characteristics.

These versions made it possible to compare four levels of verbalization 142, 97, 74, and 45 words per minute of film, respectively.

Comparisons were made between two different "how-it-works" sequences, each of which was placed at the beginning, middle, or end of a version. Further comparisons were made between versions with and without a "how-it-works" sequence.

Two versions were used to study the value of audience participation as a film utilization procedure. One version had a fast rate of development;

the other had a slow rate.

The results from a version containing a very succinct treatment of the assembly procedure, were compared with the performance of a group of trainees who had no instruction at all in assemblying the breech block, and also with one of the experimental film versions.

Finally, the teaching of nomenclature was studied by having trainees attempt to identify the parts of the breech block after seeing versions in which the parts were referred to by their technical names.

The film versions were shown to equivalent groups of naval trainees who were then provided with disassembled breech blocks and asked to assemble them. Each assembler was timed with a stop watch.

Results and Conclusions

1. It is possible to have too many or too few words in the narration of an instructional film. In this experiment medium verbalization (about 100 words per minute of film) proved to be most effective.

2. The inclusion of a "how-it-works" sequence explaining the principles of operation of the mechanism did not contribute to the learning of the assembly task.

3. Having the audience perform the task at the same time as it is being shown on the screen is an effective utilization procedure if the rate of development of the film is slow enough to permit the learners to view the film and perform the task without too much loss of attention to either.

4. A rapid, compact treatment in the film presentation of an assembly task is likely to be exceedingly ineffective. This emphasizes the need for gearing the rate of development of a film to the trainees' rate of learning.

5. Merely using technical nomenclature in the films did not effectively teach the names of the parts. If it is necessary for trainees to learn the technical names of parts, this should be regarded as an additional teaching burden, and the film treatment should be extended accordingly.

EFFECTS ON TRAINING OF EXPERIMENTAL FILM VARIABLES STUDY II: VERBALIZATION, "HOW-IT-WORKS", NOMENCLATURE, AUDIENCE PARTICIPATION, AND SUCCINCT TREATMENT.

By Nathan Jaspen

INTRODUCTION

Statement of the Problem

The purpose of the study was (1) to evaluate the relative effects on learning of controlled content characteristics of instructional films designed to teach a perceptual-motor skill, and (2) to evaluate audience participation as a film utilization technique.

The variables studied were:

1. Level of verbalization, or the number of words used in the narration to describe the action on the screen (expressed in average number of words per minute of film.)

2. The inclusion of a sequence explaining "how-it-works", or the principles of operation of the breech block of the 40mm anti-aircraft gun.

3. Audience participation, in which trainees actually attempted to assemble the breech block at the same time as the assembly procedure was being shown on the screen.

4. Succinct treatment, or the use of a brief, concise, but complete demonstration taken from an existing training film.

In addition, an attempt was made to determine the effectiveness of two of the film versions for teaching technical nomenclature.

This project is an extension of an earlier study, Project No. 10.[1]

The performance task used in both investigations was the assembling of the breech block of the 40mm anti-aircraft gun. Speed in correctly assembling

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1 The Effects on Training of Experimental Film Variables, Study I: Verbalization, Rate of Development, Nomenclature, Showing of Errors, "How-it-Works", Repetition. The Pennsylvania State College, Instructional Film Research Program.

the breech block constituted the criterion measure.

Brief Review of Results of Study I

This second study was undertaken to extend the results of Project No. 10 (Study I), and to provide additional information on related problems. Project No. 10 used 17 experimental versions of a film on the assembly of the breech block. The variables included in various combinations in these 17 versions were: rate of development, showing of errors to be avoided, repetition, level of verbalization, "how-it-works", and the use of technical terms.

It was found that a slow rate of development, the showing of errors to be avoided, and repetition contributed positively and markedly to the effectiveness of the film. No consistent difference in effectiveness was found between a high and a low level of verbalization as used in these film versions. The inclusion of a "how-it-works" sequence, showing the principles of operation of the breech block, and why the parts fit together as they do, in order to function, was found to contribute nothing, and possibly to detract from the effectiveness of the film. Finally, the employment of the technical names of the parts of the breech block, the nomenclature variable, was found not to aid the learning of the assembly task.

Restatement of the Problems for Study II

Verbalization: In the first study only two levels of verbalization were tested - a high level and a low level. No significant difference was found. However, there remained the possibility that the effectiveness of the verbalization variable might be a curvilinear function with some intermediate level being more effective than either extreme. Accordingly in Study II, film versions were prepared to test four levels of verbalization: high, medium, low, and very low. These versions will be described in the next section.

"How-it-works". The basic "how-it-works" sequence used in Study I to show the principles of operation of the breech block was found to be lacking in effectiveness. Accordingly in Study II it was decided to compare this sequence (sequence A) with another especially produced "how-it-works" sequence which was available from Study I (but which had not been tested specifically in that study). This sequence was designated sequence B.

In addition it was decided to test the effect of several different placements of each of these two sequences (at the beginning, middle, or end of the film) to determine whether there is an optimum position for the "how-it-works" sequence in the film.

Finally, it was decided to test again whether a "how-it-works" sequence, in general, contributes to film effectiveness in teaching an assembly skill.

Nomenclature. In the first study it was found that the use of technical nomenclature did not help trainees to learn the assembly of the breech block. This finding gave rise to the question: If it did not help trainees to acquire the skill, did it, at least, help them to learn the names of the parts? Two film versions produced for use in Study I, were used to investigate this question.

In addition to the above, two other variables were studied:

Audience participation. The findings with respect to audience participation as a utilization variable in another study (Project 14, see Technical Report SDC 269-7-5) did not appear to be conclusive. Therefore, a further investigation of this variable was undertaken, with the assembly of the breech block as the performance task.

In the present study it was hypothesized that for participation to be effective, a slow rate of development of the film is essential. The rate of development should be slow enough to permit the trainees both to assemble the breech block, and follow the action on the screen without too much loss of attention to either activity. To test the value of participation the trainees were asked to go through the assembly of the breech block at the same time as it was being demonstrated on the screen. The performance test was given immediately after the film showing. Two film versions produced for use in Study I were used to investigate this variable.

Succinct treatment. One of the most important results of the first study was the finding that a slow rate of development was much more effective than a fast rate. While educators have believed this for some time, many film producers and technical advisers have apparantly regarded a "slick" compact treatment as entirely satisfactory, as many instructional films exhibit this characteristic. "Succinct treatment" is not distinct from the other variables tested. The term is used to refer to a production practice which may be considered as a complex of variables. It involves a fast rate of development; it minimizes the use of repetitions; it presents generally only the bare essentials of a task to be learned. It is a complete but minimum film presentation.

In order to test the effectiveness of a "succinct treatment", a complete section (3 minutes in length) on the assembly of the breech block was taken from an existing training film, and the learning which resulted from seeing it was compared with that which resulted from other film versions in the study. As a further basis for comparison one group of trainees was subjected to a "no-film" treatment. These trainees were asked to attempt to assemble the breech block without the benefit of instruction by film or any other method.

PROCEDURE

The Experimental Film Versions

The following film versions were used to investigate the effect of the above mentioned variables on learning the assembly of the breech block:

Level of Verbalization

Version W. This film has a slow rate of development, a high level of verbalization and shows errors to be avoided. It does not use technical nomenclature, or a "how-it-works" sequence. The average number of words per minute of film is 142, and the running time is 13 minutes.

Version X. This version differs from W only in the amount of narration, which averages 97 words per minute of film. This is designated as a medium level of verbalization.

Version Y. This version has an average of 74 words for each minute of film, which is designated as a low level of verbalization.

Version Z. This version has an average of 45 words for each minute of film, which is designated, as a very low level of verbalization.

All these versions are identical except for the varying levels of verbalization "How-it-works".

Version D. This version was taken from the series used in Study I. It has a slow rate of development, a high level of verbalization, shows errors to be avoided, but does not use technical nomenclature. "How-it-works" sequence A is included near the beginning of the film. This version is 18 minutes long.

Version R. This version is identical with Version D except that the "how-it-works" sequence A is included in the middle of the film between two demonstration sequences.

Version S. This version is identical with D except that "how-it-works" sequence A is included near the end of the film, just before the concluding sequence.

Version T. This version is identical with D except that "how-it-works" sequence B replaces A near the beginning of the film.

Version U. This version is identical with T except that "how-it-works" sequence B is included in the middle of the film.

Version V. This version includes "how-it-works" sequence B near the end of the film.

Version T-X. This was a special hybrid version which was prepared to study the effects of the new "how-it-works" sequence B with a medium level of verbalization. (Versions D, R, S, T, U, and V all use a high level of verbalization.)

Nomenclature

Version A. This version has a slow rate of development, a high level of verbalization, shows errors to be avoided, includes "how-it-works" sequence A, and uses technical nomenclature. It runs 18 minutes.

Version J. This version has a fast rate of development, a low level of verbalization and uses technical nomenclature. It lacks errors and "how-it-works". This version runs five minutes.

After seeing one or the other of these film versions, the trainees were shown a photograph of the seven parts of the breech block and asked to name as many parts as they could.

Audience Participation

Version H. This version has a slow rate of development, a high level of verbalization, and technical nomenclature. It does not show errors to be avoided or "how-it-works". It runs 11 minutes.

Version O. This version has a fast rate of development, a low level of verbalization and shows "how-it-works". It does not show errors to be avoided, nor does it use technical nomenclature. It differs from all the other films in the study in having only one assembly demonstration sequence. It is seven minutes long.

Succinct Treatment.

Version Ø. This version was made up of a section of an existing training film. It begins with the disassembly of the breech block, a procedure which was not shown in any of the other experimental versions. The demonstrator then cleans off the block and reassembles it. The rate of development is very fast, and repetition is not used. The entire film in only 3 minutes in length.

The Population

Thirty three companies of approximately 60 men each were included in this study, which was conducted at the Great Lakes Naval Training Station. The total number of trainees who participated was 1818. The following personnel data were obtained for each individual: Navy General Classification Test score, Navy Mechanical Aptitude Test score, year of birth, and number of years of education. Analysis of these matching data showed that there were no differences among the means or variances of the groups larger than could be attributed to chance

Test Procedure

Each company was split at random into four details. Each detail was shown a different film version. The test session for each company lasted one hour. A total film group comprised eight such details, with no two details from the same company in any group. As nearly as possible each of the eight details in a film group saw the film at a different hour of day.

Following the showing of a film version, each trainee was given a disassembled breech block, and asked to assemble it as quickly as possible. Each subject was allowed up to ten minutes, and only one trial was permitted. The proctors followed standard instructions in testing. Time scores were measured with a stop watch, and recorded on a special form as soon as each trial was completed. Selected individuals with superior scores on the General Classification Test served as proctors.

Statistical Procedure

The time scores in seconds were converted to speed scores in units of work completed per thousand seconds (e.g. a time score of 200 seconds converts to a speed score of 5.) This conversion made possible the computation of moment statistics (means and standard deviations) which could not be obtained for the time scores when failures (infinite time scores) occurred in testing. The relative effectiveness of the versions was determined by comparing, for pairs of films, the mean speed scores obtained by the film groups which had seen these films. The stability of the differences between these pairs of means was determined on the basis of large scale sampling theory.

RESULTS

The performance of the various groups is summarized in Table 1. Table 2 shows the differences in effectiveness between pairs of films.

Verbalization. A significant difference in effectiveness was obtained between medium and very low levels of verbalization, but not between medium

TABLE 1

EFFECTIVENESS OF VARIOUS FILM VERSIONS DESIGNED TO TEACH THE ASSEMBLY OF THE BREECH BLOCK, AS MEASURED BY SPEED SCORES

(Work Units per 1000 Seconds)

Variable	Version	Length (Min.)	No. of Men in Group	Mean Speed Score	Standard Deviation
Verbalization					
High level (142 wpm)	W	13	113	9.58	4.80
Medium level (97 wpm)	X	13	115	10.35	5.39
Low level (74 wpm)	Y	13	116	9.18	4.60
Very low level (45 wpm)	Z	13	98	8.35	5.16
"How-it-works" (High verbalization)					
Sequence A-beginning	D	18	117	9.56	6.16
-middle	R	18	110	8.75	5.58
-end	S	18	111	8.33	5.73
Sequence B-beginning	T	17	118	10.36	5.62
-middle	U	17	106	8.65	5.49
-end	V	17	115	8.24	5.24
"How-it-works" (Medium verbalization)					
Sequence B-beginning	T-X	17	110	9.19	4.51
Participation					
Slow development with participation	H	11	124	14.52	10.02
Slow development without participation	H[a]	11	116	7.36	4.93
Fast development with participation	O	7	121	1.50	2.42
Fast development without participation	O[a]	7	118	2.09	2.07
Succinct Treatment					
Existing film	ø	3	103	1.49	3.44
No film	No film	0	113	.44	.86

a Results from Study I (1948).

TABLE 2

DIFFERENCES AND SIGNIFICANCE OF DIFFERENCES IN PERFORMANCE (BASED ON BREECH BLOCK ASSEMBLY SPEED SCORES) BETWEEN SELECTED PAIRS OF FILMS

Variable	Mean 1	Mean 2	Difference	Standard Error of Difference	Critical Ratio[a]
Verbalization					
W and X	9.58	10.35	-.77	.68	-1.14
X and Y	10.35	9.18	1.17	.66	1.76
Y and Z	9.18	8.35	.83	.68	1.23
X and Z	10.35	8.35	2.00	.73	2.75**
T and T-X	10.36	9.19	1.17	.68	1.72
X and T-X	10.35	9.19	1.16	.66	1.74
"How-it-works"					
D and W	9.56	9.58	-.02	.73	-..03
T and W	10.36	9.58	.78	.69	1. 13
T X and X	9.19	10.35	-1.16	.66	-1.74
"How-it-works" Sequence A					
D and R	9.56	8.75	.81	.78	1.04
R and S	8.75	8.33	.41	.76	.54
D and S	9.56	8.33	1.22	.79	1.55
"How-it-works" Sequence B					
T and U	10.36	8.65	1.71	.75	2.29*
U and V	8.65	8.24	.41	.73	.56
T and V	10.36	8.24	2.11	.71	2.95**
"How-it-works" Sequence A vs. Sequence B					
D and T	9.56	10.36	-.80	.77	-1.04
R and U	8.75	8.65	.09	.76	.13
S and V	8.33	8.24	.09	.73	.12
Participation					
H (with) and H (without)	14.52	7.36	7.16	1.13	6.34**
O (with) and O (without)	1.50	2.09	-.59	.49	-1.21
H (with) and O (without)	14.52	1.50	13.02	.93	14.01**
Succinct Treatment					
V and Ø	8.24	1.49	6.76	.60	11.31**
Ø and No Film	1.49	.44	1.04	.35	2.98**

* Significant at the 5% level

** Significant at the 1% level

a The sign of the critical ratio if positive indicates that the first film in the pair is better, and if negative, indicates that the second film is better.

TABLE 3

NUMBER OF ITEMS OF TECHNICAL NOMENCLATURE RECALLED AFTER FILM SHOWINGS [a]

Film Version	No. of Men	Mean Score	Standard Deviation
A (slow film)	113	2.75	1.63
J (fast film)	15	1.13	.34

a Possible score 7.

and high, or medium and low. In general, there appeared to be a curvilinear relationship between level of effectiveness of the film and level of verbalization (measured in number of words of narration per minute of film), with the apex at the medium level of verbalization (about 100 words per minute of film).

"How-it-Works". Comparisons between Version D and W, T and W, and T X and X (in each pair the first film has a "how-it-works" sequence, and the second film lacks such a sequence) yield inconsistent results and no significant differences. This was also the finding regarding "how-it-works" in Study I. Comparisons under "how-it-works" Sequence A and "how-it-works" Sequence B indicate that the best position for these sequences is at the beginning of the film rather than the middle or end. In the next set of comparisons, no significant differences appear between Sequences A and B, indicating that the conclusions heretofore reached regarding this variable can to some extent be generalized beyond a single specific sequence embodying the variable.

Participation. A very large significant difference was found in the comparison of Version H with participation with Version H without participation, in favor of participation. For Version O, a fast development film, the difference was in the other direction, though not at a significant level. The slow development film (H) with participation was found to be much more effective than the fast development film (O) with participation.

Succinct Treatment. Film Ø was compared with Film V, the least effective of the regular series of films used in this study. The result was heavily in favor of Film V. Nevertheless, Film Ø was found to be significantly better than no film at all.

Nomenclature. Table 3 summarizes the statistics with regard to the learning of technical nomenclature.

The scores indicate that using technical nomenclature in the films did not effectively teach it. There was no intention, in this study of nomenclature, to compare the effectiveness of the two film versions used. The two versions were selected only to establish the general level of effectiveness of the breech block film series for teaching technical nomenclature. It was presumed that Version A would be more effective in this regard than most of the other films in the series.

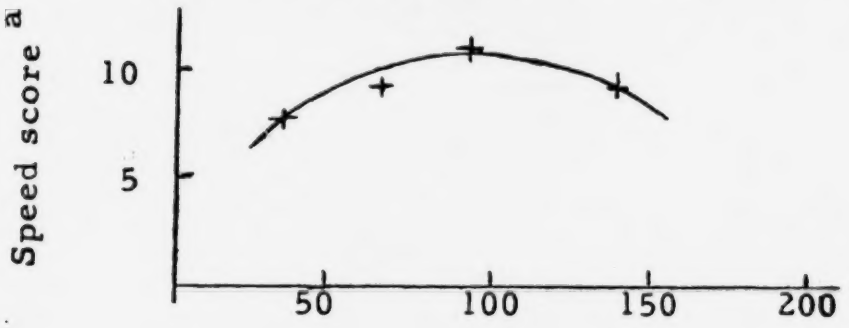
CONCLUSIONS

The following conclusions appear to be valid for this particular task:

1. The relationship between level of effectiveness of the film and level of verbalization (amount of narration used to describe the action), appears to be curvilinear, with the apex of the curve at the medium level of verbalization (approximately 100 words for each minute of film.)

FIGURE 1

RELATIONSHIP BETWEEN LEVEL OF VERBALIZATION AND EFFECTIVENESS OF AN INSTRUCTIONAL FILM



2. The two "how-it-works" sequences are approximately of the same order of effectiveness. Comparisons between various versions suggest that neither "how-it-works" sequence contributed markedly to learning the assembly task. The "how-it-works" sequences at the beginning of the film were rather more effective than when placed in the middle or near the end of the film.

3. The films using the technical names of the parts in describing the assembly procedure were ineffective in <u>teaching</u> the names of the parts.

4. Audience participation is a very effective utilization procedure in teaching this task, when the rate of development of the film is slow enough to permit the learners to view the film and assemble the breech block without too much loss of attention to either. Conversely, the requirement of audience participation seems to have a negative effect if the film develops rapidly.

5. A succinct treatment of the film presentation of an assembly task may be exceedingly ineffective. The least effective version (V) of the regular series of breech block films used in this study was 450% better than the "succinct treatment" film, while the best version (T) was 600% better.

a Based on assembly time - see page 8